

**MODEL NO. :** TM190MFS02**ISSUED DATE:** 2012/05/10**VERSION :** 1.0☐ **Preliminary Specification**☒ **Final Product Specification****Customer :** \_\_\_\_\_

| Approved by | Notes |
|-------------|-------|
|             |       |

**SHANGHAI AVIC Confirmed :**

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This technical specification is subjected to change without notice

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## RECORD OF REVISION

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|-----|-------------|--------------|---------|
| 1.0 | 2012-05-10  | First issued | Pean Wu |
|     |             |              |         |
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## 1. OUTLINE

### 1.1 STRUCTURE AND PRINCIPLE

TM190MFS02 open cell is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array. The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays. The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

### 1.2 APPLICATIONS

- Monitor

### 1.3 FEATURES

- a-Si TFT active matrix
- LVDS interface
- R.G.B input 8bit, 16.7 millions colors (6bit+Hi-FRC)
- Resolution WXGA+ (1,440× 900 pixels)
- High contrast ratio 600 :1
- Fast response time (Ton+ Toff= 5 ms)



## 2. GENERAL SPECIFICATIONS

|                          |                                         |
|--------------------------|-----------------------------------------|
| Display area             | 408.24 (H) × 255.15 (V) mm (typ.)       |
| Diagonal size of display | 480 mm (19.0 inches)                    |
| Drive system             | a-Si TFT active matrix                  |
| Display color            | 16.7 M colors (6bit+ Hi-FRC)            |
| Pixel                    | 1,440 (H) × 900(V) pixels               |
| Pixel arrangement        | RGB vertical stripe                     |
| Pixel pitch              | 0.2835 (H) × 0.2835 (V) mm              |
| Signal system            | LVDS 2port                              |
| Power supply voltage     | LCD panel signal processing board: 5.0V |
| Transmissive Mode        | Normally White                          |
| Response time            | 5 ms (typ.)                             |
| Contrast ratio           | 600 :1 (typ.)                           |
| Surface Treatment        | Anti Glare                              |

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### 3. ABSOLUTE MAXIMUM RATINGS

| Parameter                 | Symbol | Rating      | Unit             | Remarks           |
|---------------------------|--------|-------------|------------------|-------------------|
| Power supply voltage      | VDD    | -0.3 ~ +3.6 | V                | Ta = 25°C         |
| Input voltage for signals | Vi     | -0.3 ~ +3.6 | V                | Ta = 25°C         |
| Storage temperature       | Tst    | -20 ~ +60   | °C               | Note 3            |
| Operating temperature     | Top    | 0 ~ +50     | °C               | Note 3, 4         |
| Absolute humidity         | AH     | ≤ 70        | g/m <sup>3</sup> | Ta > 50°C         |
| Operating altitude        | -      | ≤ 4,850     | m                | 0°C ≤ Ta ≤ 50°C   |
| Storage altitude          | -      | ≤ 13,600    | m                | -20°C ≤ Ta ≤ 60°C |

Note1: Display signals are DA0+/-, DA1+/-, DA2+/-, DA3+/-, CKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, and CKB+/-.

Note2: Function signal is MSL.

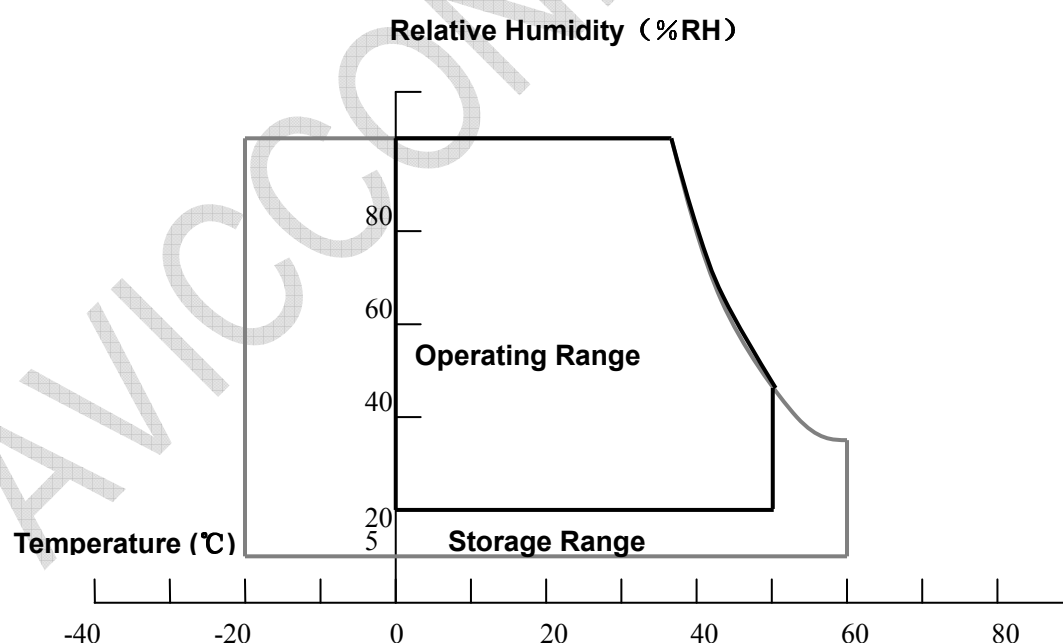
Note3: Temperature and relative humidity range is shown in the figure below.

(a) 90%RH Max. (Ta ≤ 40°C)

(b) Wet-bulb temperature should be 39°C Max. (Ta > 40°C)

(c) No condensation.

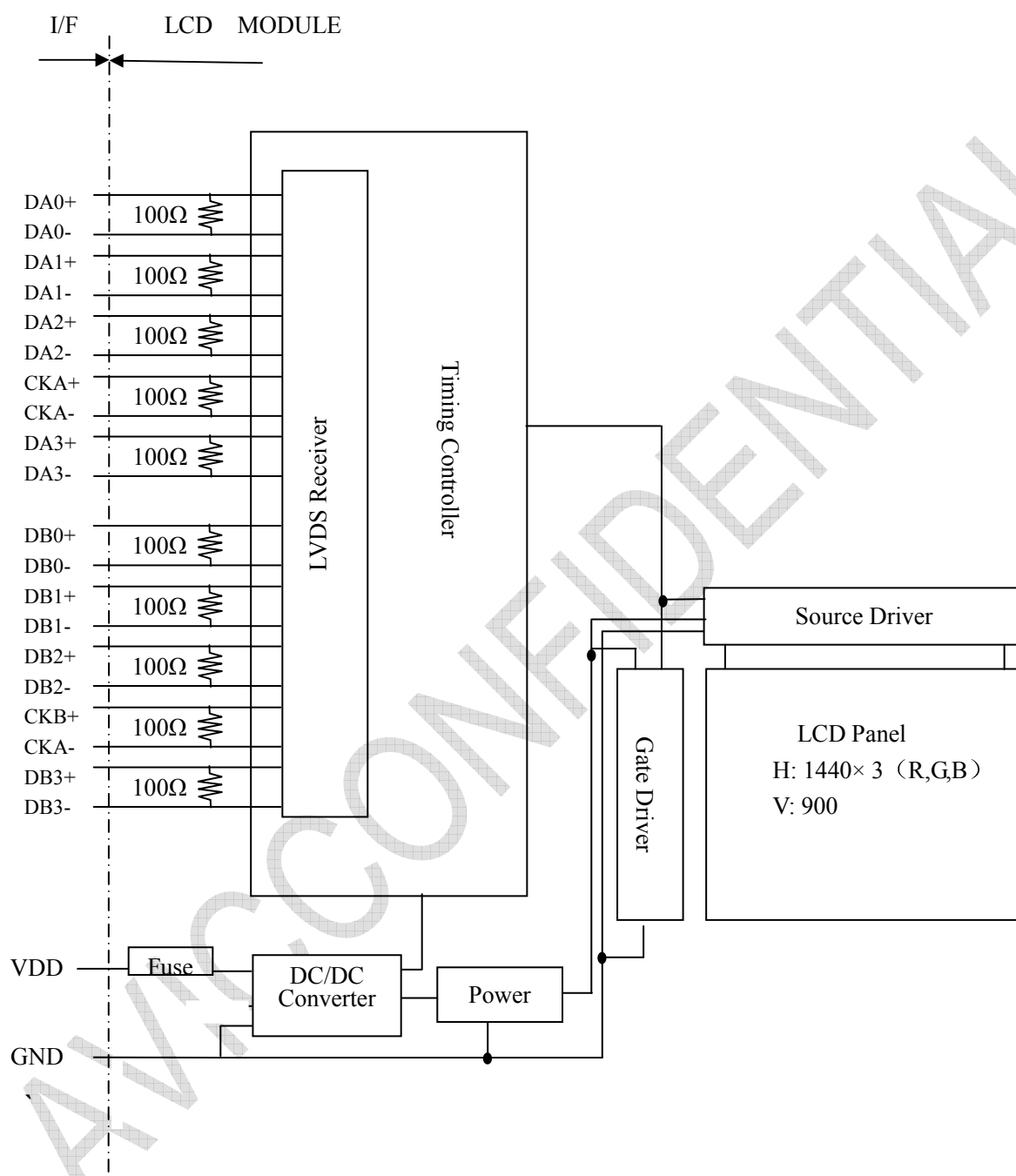
Note4: The temperature of panel display surface area should be 0°C Min and 60°C Max.



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## 4. BLOCK DIAGRAM



Note: System ground (GND), FG (Frame ground) in the product should be connected together in customer equipment.



## 5. MECHANICAL SPECIFICATIONS

| Parameter          | Specification                                            | Unit |
|--------------------|----------------------------------------------------------|------|
| Display area       | 408.24(H) × 255.15(V) mm (typ.), [48.0 cm (19.0 inches)] | mm   |
| Display dot number | 1440×3(H) ×900(V)                                        | -    |
| Pixel pitch        | 0.2835(H)×0.2835(V)                                      | mm   |
| Dot pitch          | 0.0945(H) ×0.2835(V)                                     | mm   |

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## 6. ELECTRICAL CHARACTERISTICS

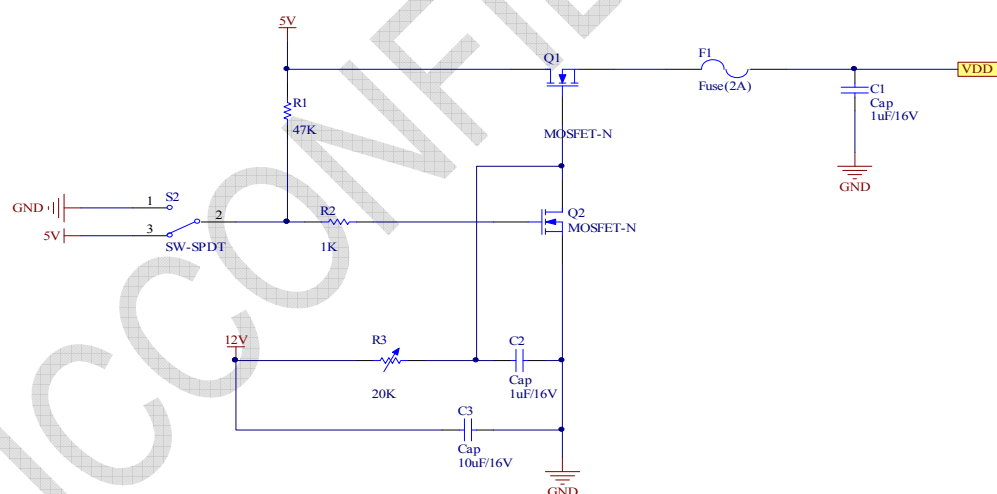
| Parameter                                              | Symbol            | min. | typ.         | max.           | Unit     | Remarks                |
|--------------------------------------------------------|-------------------|------|--------------|----------------|----------|------------------------|
| Power supply voltage                                   | VDD               | 4.5  | 5.0          | 5.5            | V        | -                      |
| Power supply current                                   | IDD               | -    | 700<br>Note1 | 1000<br>Note 2 | mA       | at VDD = 5.0V          |
| Permissible ripple voltage                             | VRP               | -    | -            | 200            | mV       | VDD                    |
| Differential input voltage                             | Vid               | 200  |              | 600            | mV       |                        |
| Differential input threshold voltage for LVDS receiver | Low               | VTL  | -100         | -              | mV       | at VCM = 1.2V<br>Note3 |
|                                                        | High              | VTH  | -            | 100            | mV       |                        |
| Input voltage width for LVDS receiver                  | Vi                | 0    | -            | 3.3            | V        | -                      |
| Terminating resistor                                   | RT                | -    | 100          | -              | $\Omega$ | -                      |
| Rush current                                           | I <sub>rush</sub> | -    | -            | 3.0            | A        | Note4                  |

Note 1: Black pattern

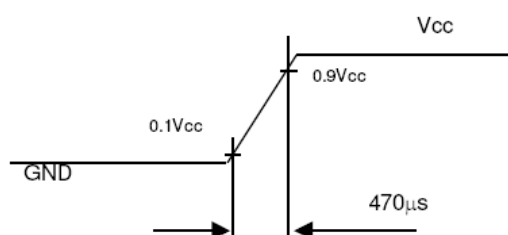
Note 2: 1H1V dot inverse pattern

Note 3: Common mode voltage for LVDS receiver

Note4: Measurement Conditions:



**Vcc rising time is 470 $\mu$ s**



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## 7. CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

### 7.1 LVDS

CN1: FI-XB30SSRLA-HF16 (Produced by JAE) or equivalent.

| Pin | Name  | Description                                              |
|-----|-------|----------------------------------------------------------|
| 1   | RXO0- | Negative LVDS differential data input. Channel O0 (odd)  |
| 2   | RXO0+ | Positive LVDS differential data input. Channel O0 (odd)  |
| 3   | RXO1- | Negative LVDS differential data input. Channel O1 (odd)  |
| 4   | RXO1+ | Positive LVDS differential data input. Channel O1 (odd)  |
| 5   | RXO2- | Negative LVDS differential data input. Channel O2 (odd)  |
| 6   | RXO2+ | Positive LVDS differential data input. Channel O2 (odd)  |
| 7   | GND   | Ground                                                   |
| 8   | RXOC- | Negative LVDS differential clock input. (odd)            |
| 9   | RXOC+ | Positive LVDS differential clock input. (odd)            |
| 10  | RXO3- | Negative LVDS differential data input. Channel O3(odd)   |
| 11  | RXO3+ | Positive LVDS differential data input. Channel O3 (odd)  |
| 12  | RXE0- | Negative LVDS differential data input. Channel E0 (even) |
| 13  | RXE0+ | Positive LVDS differential data input. Channel E0 (even) |
| 14  | GND   | Ground                                                   |
| 15  | RXE1- | Negative LVDS differential data input. Channel E1 (even) |
| 16  | RXE1+ | Positive LVDS differential data input. Channel E1 (even) |
| 17  | GND   | Ground                                                   |
| 18  | RXE2- | Negative LVDS differential data input. Channel E2 (even) |
| 19  | RXE2+ | Positive LVDS differential data input. Channel E2 (even) |
| 20  | RXEC- | Negative LVDS differential clock input. (even)           |
| 21  | RXEC+ | Positive LVDS differential clock input. (even)           |
| 22  | RXE3- | Negative LVDS differential data input. Channel E3 (even) |
| 23  | RXE3+ | Positive LVDS differential data input. Channel E3 (even) |
| 24  | GND   | Ground                                                   |
| 25  | GND   | Ground                                                   |
| 26  | NC    | Not connection.                                          |
| 27  | GND   | Ground                                                   |
| 28  | VDD   | +5.0V power supply                                       |
| 29  | VDD   | +5.0V power supply                                       |
| 30  | VDD   | +5.0V power supply                                       |

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## 7.2 CONNECTION BETWEEN RECEIVER AND TRANSMITTER FOR LVDS

| Input DATA                         |      | Transmitter |                              | CN1  |        |
|------------------------------------|------|-------------|------------------------------|------|--------|
|                                    |      | pin         | DS90CF383,C385 or equivalent | pin  | Symbol |
| Odd pixel data and control signals | RA0  | → 51        | TXIN0                        | → 1  | DA0-   |
|                                    | RA1  | → 52        | TXIN1                        | → 2  | DA0+   |
|                                    | RA2  | → 54        | TXIN2                        |      |        |
|                                    | RA3  | → 55        | TXIN3                        |      |        |
|                                    | RA4  | → 56        | TXIN4                        | → 3  | DA1-   |
|                                    | RA5  | → 3         | TXIN6                        | → 4  | DA1+   |
|                                    | GA0  | → 4         | TXIN7                        |      |        |
|                                    | GA1  | → 6         | TXIN8                        | → 5  | DA2-   |
|                                    | GA2  | → 7         | TXIN9                        | → 6  | DA2+   |
|                                    | GA3  | → 11        | TXIN12                       | → 7  | GND    |
|                                    | GA4  | → 12        | TXIN13                       | → 8  | CKA-   |
|                                    | GA5  | → 14        | TXIN14                       | → 9  | CKA+   |
|                                    | BA0  | → 15        | TXIN15                       |      |        |
|                                    | BA1  | → 19        | TXIN18                       | → 10 | DA3-   |
|                                    | BA2  | → 20        | TXIN19                       | → 11 | DA3+   |
|                                    | BA3  | → 22        | TXIN20                       |      |        |
|                                    | BA4  | → 23        | TXIN21                       |      |        |
|                                    | BA5  | → 24        | TXIN22                       |      |        |
|                                    | RSVD | → 27        | TXIN24                       |      |        |
|                                    | RSVD | → 28        | TXIN25                       |      |        |
|                                    | DE   | → 30        | TXIN26                       |      |        |
|                                    | RA6  | → 50        | TXIN27                       |      |        |
|                                    | RA7  | → 2         | TXIN5                        |      |        |
|                                    | GA6  | → 8         | TXIN10                       |      |        |
|                                    | GA7  | → 10        | TXIN11                       |      |        |
|                                    | BA6  | → 16        | TXIN16                       |      |        |
|                                    | BA7  | → 18        | TXIN17                       |      |        |
|                                    | RSVD | → 25        | TXIN23                       |      |        |
|                                    | CLK  | → 31        | CLKIN                        |      |        |
| Even pixel data                    | RB0  | → 51        | TXIN0                        |      |        |
|                                    | RB1  | → 52        | TXIN1                        | → 12 | DB0-   |
|                                    | RB2  | → 54        | TXIN2                        | → 13 | DB0+   |
|                                    | RB3  | → 55        | TXIN3                        | → 14 | GND    |
|                                    | RB4  | → 56        | TXIN4                        | → 15 | DB1-   |
|                                    | RB5  | → 3         | TXIN6                        | → 16 | DB1+   |
|                                    | GB0  | → 4         | TXIN7                        | → 17 | GND    |
|                                    | GB1  | → 6         | TXIN8                        | → 18 | DB2-   |
|                                    | GB2  | → 7         | TXIN9                        | → 19 | DB2+   |
|                                    | GB3  | → 11        | TXIN12                       |      |        |
|                                    | GB4  | → 12        | TXIN13                       | → 20 | CKB-   |
|                                    | GB5  | → 14        | TXIN14                       | → 21 | CKB+   |
|                                    | BB0  | → 15        | TXIN15                       |      |        |
|                                    | BB1  | → 19        | TXIN18                       | → 22 | DB3-   |
|                                    | BB2  | → 20        | TXIN19                       | → 23 | DB3+   |
|                                    | BB3  | → 22        | TXIN20                       | → 24 | GND    |
|                                    | BB4  | → 23        | TXIN21                       | → 25 | GND    |
|                                    | BB5  | → 24        | TXIN22                       | → 26 | NC     |
|                                    | RSVD | → 27        | TXIN24                       | → 27 | GND    |
|                                    | RSVD | → 28        | TXIN25                       | → 28 | VDD    |
|                                    | RSVD | → 30        | TXIN26                       | → 29 | VDD    |
|                                    | RB6  | → 50        | TXIN27                       | → 30 | VDD    |
|                                    | RB7  | → 2         | TXIN5                        |      |        |
|                                    | GB6  | → 8         | TXIN10                       |      |        |
|                                    | GB7  | → 10        | TXIN11                       |      |        |
|                                    | BB6  | → 16        | TXIN16                       |      |        |
|                                    | BB7  | → 18        | TXIN17                       |      |        |
|                                    | RSVD | → 25        | TXIN23                       |      |        |
|                                    | CLK  | → 31        | CLKIN                        |      |        |

Note1: The lowest bit (RA0, GA0, BA0, RB0, GB0, BB0), the most upper bit (RA7, GA7, BA7, RB7, GB7, BB7)

Note2: Connecting cable between LCD panel's connector and transmitter should use 100Ω twisted line.

Note3: If only Hsync and Vsync, the product don't work. Make sure DE signal has been input.

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## 8. DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16,777,216 colors in 256 scales. Also the relation between display colors and input data signals is as the following table.

| Display colors  |                          | Data signal (0:Low level, 1:High Level) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|--------------------------|-----------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                 |                          | R7                                      | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color     | Black                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Blue                     | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Red                      | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Magenta                  | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Green                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Cyan                     | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Yellow                   | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | White                    | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Red grayscale   | Black                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark<br>↑<br>↓<br>Bright | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 |                          | 0                                       | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 |                          | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|                 |                          | 1                                       | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | 1                        | 1                                       | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Red                      | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | 0                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Green grayscale | Black                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark<br>↑<br>↓<br>Bright | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 |                          | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 |                          | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|                 |                          | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | 0                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Green                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | 0                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Blue grayscale  | Black                    | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark<br>↑<br>↓<br>Bright | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                 |                          | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  |
|                 |                          | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|                 |                          | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|                 | 0                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                 | Blue                     | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | 0                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

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## 9. INTERFACE TIMING

### 9.1 TIMING CHARACTERISTICS

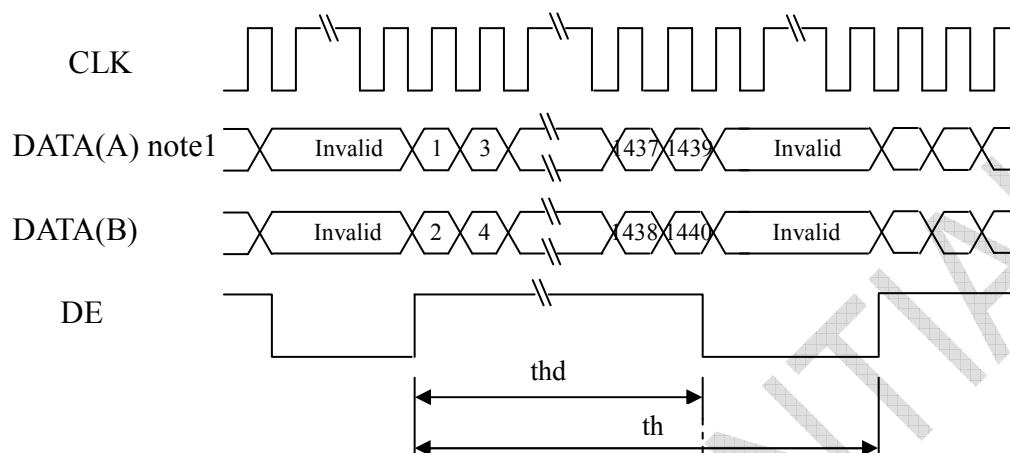
| Parameter          |                      | Symbol | min.                                                    | typ.  | max.  | Unit | Remarks                |
|--------------------|----------------------|--------|---------------------------------------------------------|-------|-------|------|------------------------|
| Clock              | Frequency            | 1/tc   | 37.04                                                   | 44.45 | 55.56 | MHz  | LVDS transmitter input |
|                    |                      | tc     | 27.0                                                    | 22.50 | 18.0  | ns   |                        |
|                    | Rise time, Fall time | -      | Refer to the timing characteristics of LVDS transmitter |       |       | ns   | Note 1                 |
|                    | Duty                 | -      |                                                         |       |       | -    |                        |
| Horizontal signals | Cycle                | th     | 148                                                     | 18.0  | 26.5  | μs   | 55.5kHz(typ.)          |
|                    |                      |        | 754                                                     | 800   | 900   | CLK  |                        |
|                    | Display period       | thd    | 720                                                     |       |       | CLK  | -                      |
| Vertical signals   | Cycle                | tv     | 133                                                     | 1667  | 20    | ms   | 60.0Hz(typ.)           |
|                    |                      |        | 912                                                     | 926   | 1100  | H    |                        |
|                    | Display period       | tvd    | 900                                                     |       |       | H    | -                      |
| DE/Data            | Setup time           | -      | Refer to the timing characteristics of LVDS transmitter |       |       | ns   | Note 1                 |
|                    | Hold time            | -      |                                                         |       |       | ns   |                        |
|                    | Rise time, Fall time | -      |                                                         |       |       | ns   |                        |

Note1: See the data sheet of LVDS transmitter.

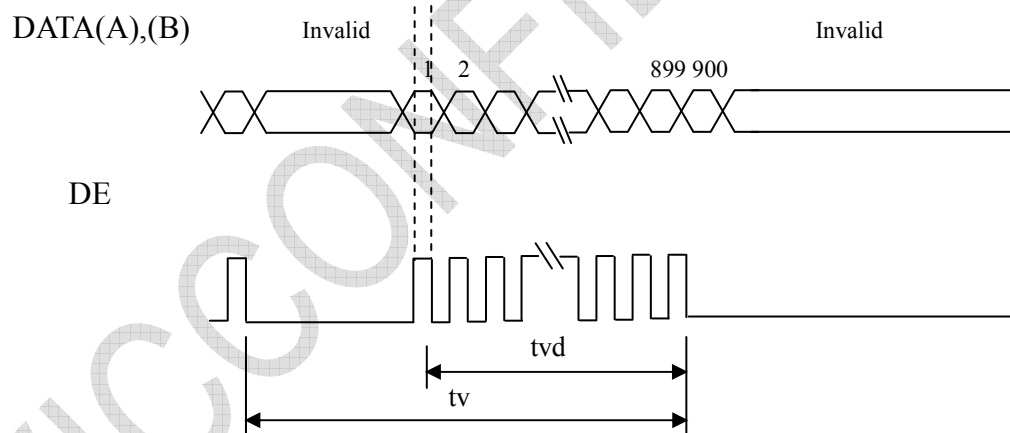


## 9.2 INPUT SIGNAL TIMING CHART

## Horizontal timing



## Vertical timing



Note 1:

DATA(A)=RA0-RA7,GA0-GA7,BA0-BA7

DATA(B)=RB0-RB7,GB0-GB7,BB0-BB7



### 9.3 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE

The following chart is the coordinates of per pixel

Odd Pixel: RA= R DATA

Even Pixel : RB=R DATA

GA= G DATA

GB=G DATA

BA= B DATA

BB=B DATA

| D(1,1) |    |        | D(2,1) |    |    |
|--------|----|--------|--------|----|----|
| RA     | GA | B<br>A | RB     | GB | BB |

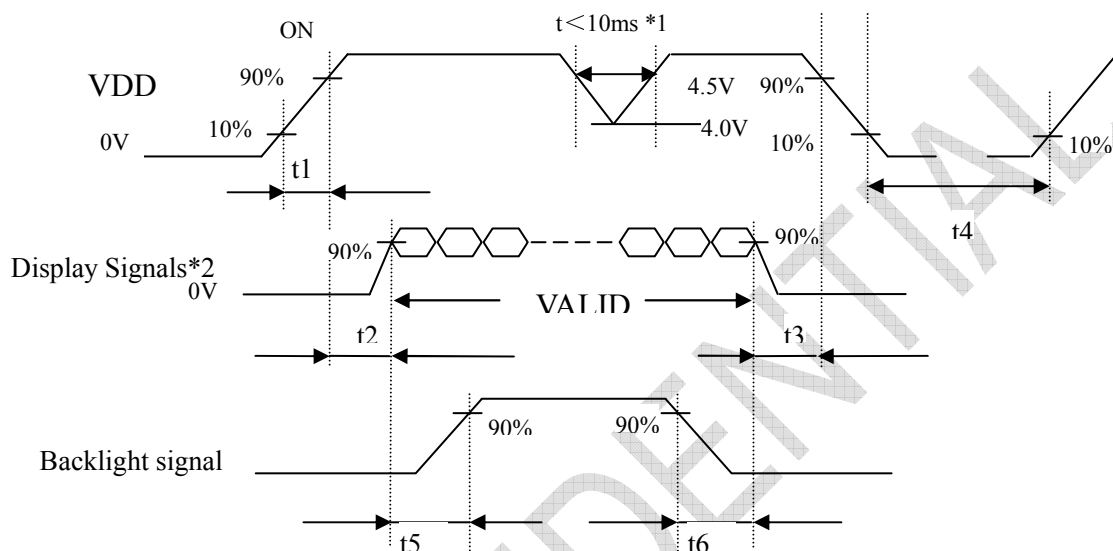
|          |          |          |     |             |
|----------|----------|----------|-----|-------------|
| D(1,1)   | D(2,1)   | D(3,1)   | ... | D(1440,1)   |
| D(1,2)   | D(2,2)   | D(3,2)   | ... | D(1440,2)   |
| D(1,3)   | D(2,3)   | D(3,3)   | ... | D(1440,3)   |
| •        | •        | •        | ... | •           |
| •        | •        | •        | ... | •           |
| •        | •        | •        | ... | •           |
| D(1,900) | D(2,900) | D(2,900) | ... | D(1440,900) |

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## 9.4. POWER SUPPLY VOLTAGE SEQUENCE

### 9.4.1 The sequence of backlight and power



#### Timing Specifications:

t1 0.47ms < t1 < 10ms

t2 0.5 ms < t2 < 50ms

t3 0ms < t3 < 50ms

t4 > 1000ms

t5 > 200ms

t6 > 200ms

\*1. When VDD is on, but the value is lower than 4.5V, a protection circuit may work, then the module may not display.

\*2 The signal line is not connected with the module, at the end of cable the terminal resistor of 100Ω should be added.

Note1: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) must be "0" voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged.

If some of display signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display signals, they should cut VDD.

Note2: When VDD is on, it should be set above 4.0V.

Note3: The backlight power supply voltage should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

### 9.4.2 Power supply voltage ripple

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When the power supply is designed, the next form can give the reference. If the voltage ripple is over the value in next form, the noise should be seen in display area.

Ripple (Measured at input terminal of power supply)

|                |                                                |
|----------------|------------------------------------------------|
|                | VDD (5V to drive the panel)                    |
| Ripple voltage | $\leq 150\text{mVP-P}$ (Including spike noise) |

#### 9.4.3 Fuse

| Parameter | Fuse             |          | Rating    | Fusing current | Remarks |
|-----------|------------------|----------|-----------|----------------|---------|
|           | Type             | Supplier |           |                |         |
| VDD       | F0603FA2000V032T | AEM      | 2A<br>32V | 4A             | Note1   |

Note1: There are different power supply systems from the power input terminal. The power supply capacity should be less than the fusing current. If the power supply capacity is above the fusing current, the fuse may blow in a short time, and then nasty smell, smoking and so on may occur.



## 10. OPTICS

### 10.1 Optical characteristics

Base on TFT-LCD module TM190MDS01

Note1 ,Note2

| Parameter Note1      |       | Condition                                              | Symbol | min.  | typ.  | max.   | Unit               | Remarks       |
|----------------------|-------|--------------------------------------------------------|--------|-------|-------|--------|--------------------|---------------|
| Luminance            |       | White at center<br>θR=0°, θL=0°, θU=0°,<br>θD=0°       | L      | 160   | 200   | -      | cd/ m <sup>2</sup> | -             |
| Contrast ratio       |       | White/Black at center<br>θR=0°, θL=0°, θU=0°,<br>θD=0° | CR     | (420) | 600   | -      | -                  | Note3         |
| Luminance uniformity |       | White<br>θR=0°, θL=0°, θU=0°,<br>θD=0                  | LU     | -     | 1.25  | (1.33) | -                  | Note4         |
| Chromaticity         | White | X coordinate                                           | Wx     | 0.283 | 0.313 | 0.343  | -                  | Chromaticity  |
|                      |       | Y coordinate                                           | Wy     | 0.299 | 0.329 | 0.359  | -                  |               |
|                      | Red   | X coordinate                                           | Rx     | 0.617 | 0.647 | 0.677  | -                  |               |
|                      |       | Y coordinate                                           | Ry     | 0.310 | 0.340 | 0.370  | -                  |               |
|                      | Green | X coordinate                                           | Gx     | 0.253 | 0.283 | 0.313  | -                  |               |
|                      |       | Y coordinate                                           | Gy     | 0.574 | 0.604 | 0.634  | -                  |               |
|                      | Blue  | X coordinate                                           | Bx     | 0.113 | 0.143 | 0.173  | -                  |               |
|                      |       | Y coordinate                                           | By     | 0.037 | 0.067 | 0.097  | -                  |               |
| Color gamut          |       | θR=0°, θL=0°, θU=0°,<br>θD=0<br>At center,against NTSC | C      | -     | 72    | -      | %                  |               |
| Response time        |       | White to black                                         | Ton    | -     | 1.3   | (2.6)  | ms                 | Note6         |
|                      |       | Black to white                                         | Toff   | -     | 3.7   | (7.4)  | ms                 |               |
|                      |       | Ton+ Toff                                              | -      | -     | 5     | (10)   | ms                 | Note7         |
| Viewing angle        | Right | θU=0°, θD=0°, CR≥10                                    | θR     | -     | 45    | -      | °                  | Viewing angle |
|                      | Left  | θU=0°, θD=0°, CR≥10                                    | θL     | -     | 45    | -      | °                  |               |
|                      | Up    | θR=0°, θL=0°, CR≥10                                    | θU     | -     | 25    | -      | °                  |               |
|                      | Down  | θR=0°, θL=0°, CR≥10                                    | θD     | -     | 45    | -      | °                  |               |

Note1: The values in upper table are only initial characteristics, and measured with AVIC backlight unit

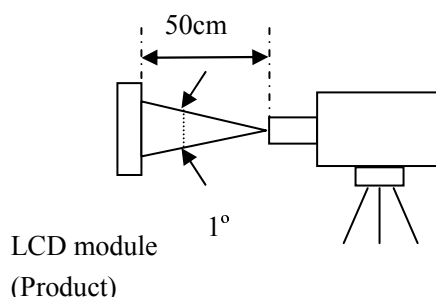
Note2: Measurement conditions are as follows.

Ta= 25°C, VDD= 5.0V, IBL= 6.5mA/m, Display mode: WXGA+,

Horizontal cycle=55.56KHz, Vertical cycle=60.0Hz

Optical characteristics are measured at luminance saturation after 30minutes from working the product in the dark room. Also measurement method for luminance is as follows.

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Luminance Meter (TOPCON BM-5A)

Spectroradiometer(TOPCON SR-3)

Note 3: See "10.2 Definition of contrast ratio".

Note 4: See "10.3 Definition of luminance uniformity".

Note 5: CIE 1931 Chromaticity Diagram Standard.

Note 6: Product surface temperature: TopF = 33.0 °C

Note 7: See "10.4 Definition of response time".

Note 8: See "10.5 Definition of viewing angle".

## 10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

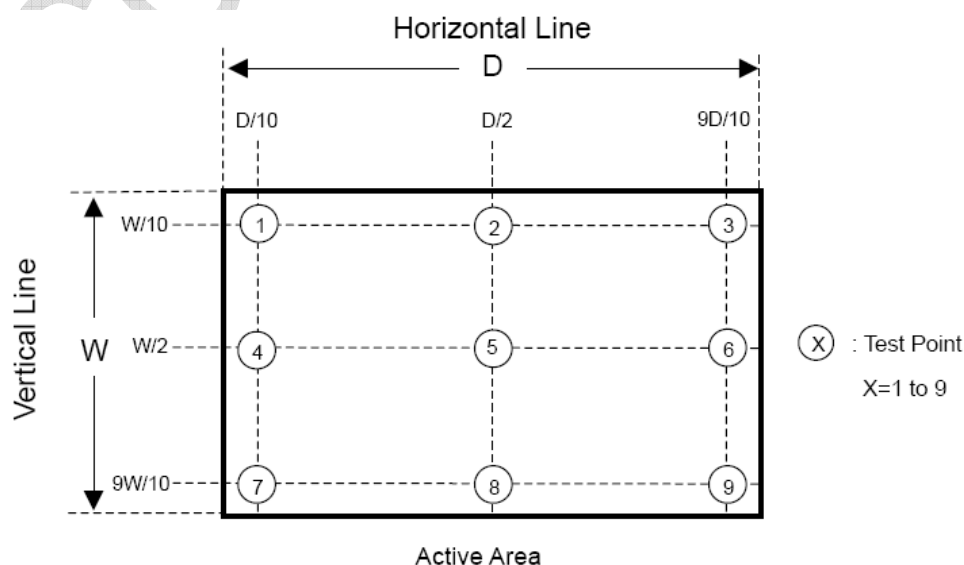
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

## 10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using the following formula.

$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.

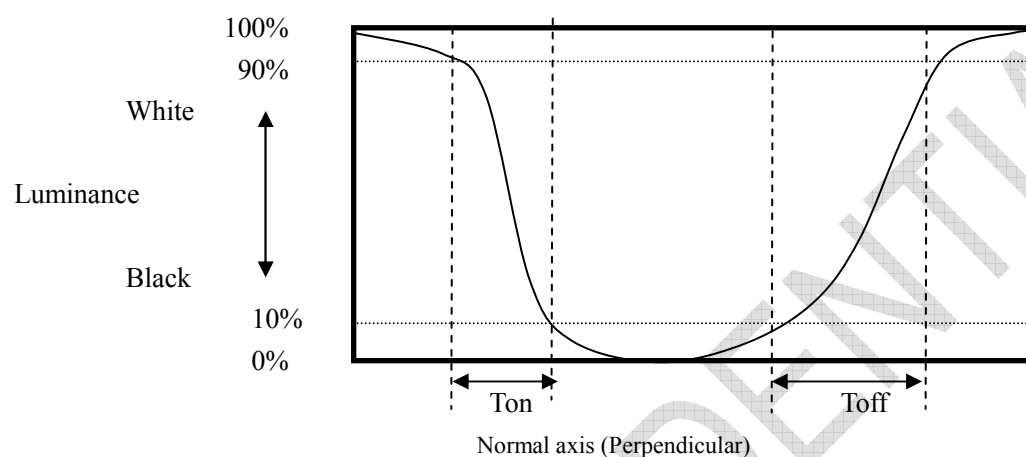


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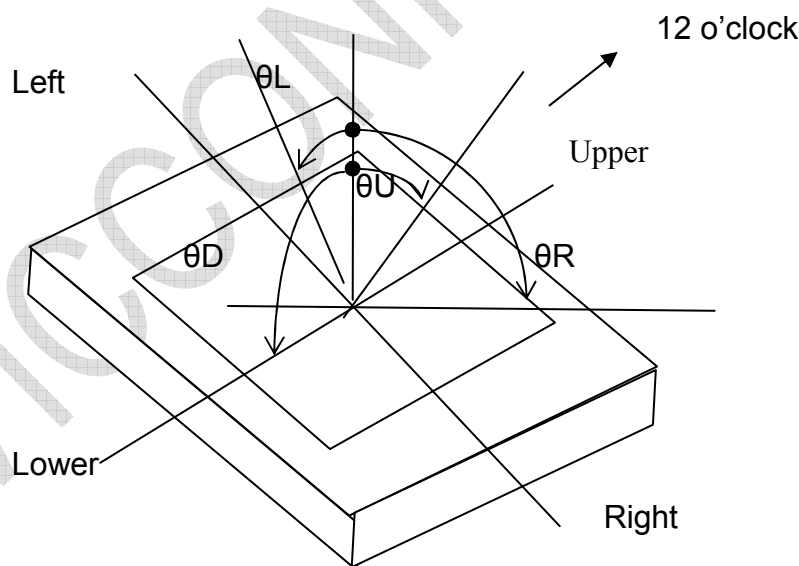


## 10.4 Definition of response times

Response time is measured, the luminance changes from “white” to “black”, or “black” to “white” on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90%. (See the following diagram.)



## 10.5 Definition of viewing angles





## 11. MARKINGS

AVIC will pack products to deliver to customer in accordance with AVIC packing specifications, and will deliver products to customer in such a state that products will not suffer from damage during transportation .The delivery conditions are as follows.

### 11.1 PRODUCT LABEL

Product label



Open cell barcode:

•Example: 9WX0818C23916121011H6H109505003

|                          |                     |                      |
|--------------------------|---------------------|----------------------|
| <u>190M01</u>            | <u>18C239161210</u> | <u>116H109505003</u> |
| Open cell<br>Number Code | Cell ID             | Lot number           |

Cell ID: 18C239161210

|          |                                            |                                    |                      |                                |
|----------|--------------------------------------------|------------------------------------|----------------------|--------------------------------|
| <u>1</u> | <u>8</u>                                   | <u>C</u>                           | <u>23</u>            | <u>9161210</u>                 |
| S1 Line  | Manufacturing year<br>(e.g:A.D2008 is 08.) | Manufacturing<br>month<br>1 letter | Manufacturing<br>day | Panel Location<br>Internal use |

Jan. to Sep.: Number of month  
October: A  
November: B  
December: C

Lot number: 11H6H109505003

|                 |                                                                                     |                                    |                      |                                                  |
|-----------------|-------------------------------------------------------------------------------------|------------------------------------|----------------------|--------------------------------------------------|
| <u>116H1</u>    | <u>09</u>                                                                           | <u>5</u>                           | <u>05</u>            | <u>003</u>                                       |
| Internal<br>use | Manufacturing year<br>2 figures of the A.D. end<br>numbers<br>(e.g: A.D2009 is 09.) | Manufacturing<br>month<br>1 letter | Manufacturing<br>day | Production<br>number<br>Multi-letter<br>(figure) |

Jan. to Sep.: Number of month  
October: A  
November: B  
December: C

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## 11.2 PACKING

### (1) Packing box

5 products are packed up with the maximum in a packing box(See “11.6 OUTLINE FIGURE FOR PACKING”).

Products are put into a plastic bag for prevention of moisture.

The type name and quality are shown on outside of the packing box, either labeling or printing.

### (2)Pallet Packing (See”11.6 OUTLINE FIGURE FOR PACKING “)

① Packing boxes are tired on a cardboard pallet.

②Cardboard sleeve and top cap are attached to the packing boxes, and then they are fixed by a band.

## 11.3 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with delivery products to customer. It is summarized to a number of products for pass/fail assessment.

## 11.4 TRANSPORTATION

The product is transported by vehicle, aircraft or shipment in the state of pallet packing.

## 11.5 SIZE AND WEIGHT FOR PACKING BOX

| Parameter    | Packing box                       | Unit |
|--------------|-----------------------------------|------|
| Size         | 571×459×274(typ.)                 | mm   |
| Weight       | 0.46(typ.)                        | kg   |
| Total weight | 19.1<br>(typ., with 30 PCS panel) | kg   |

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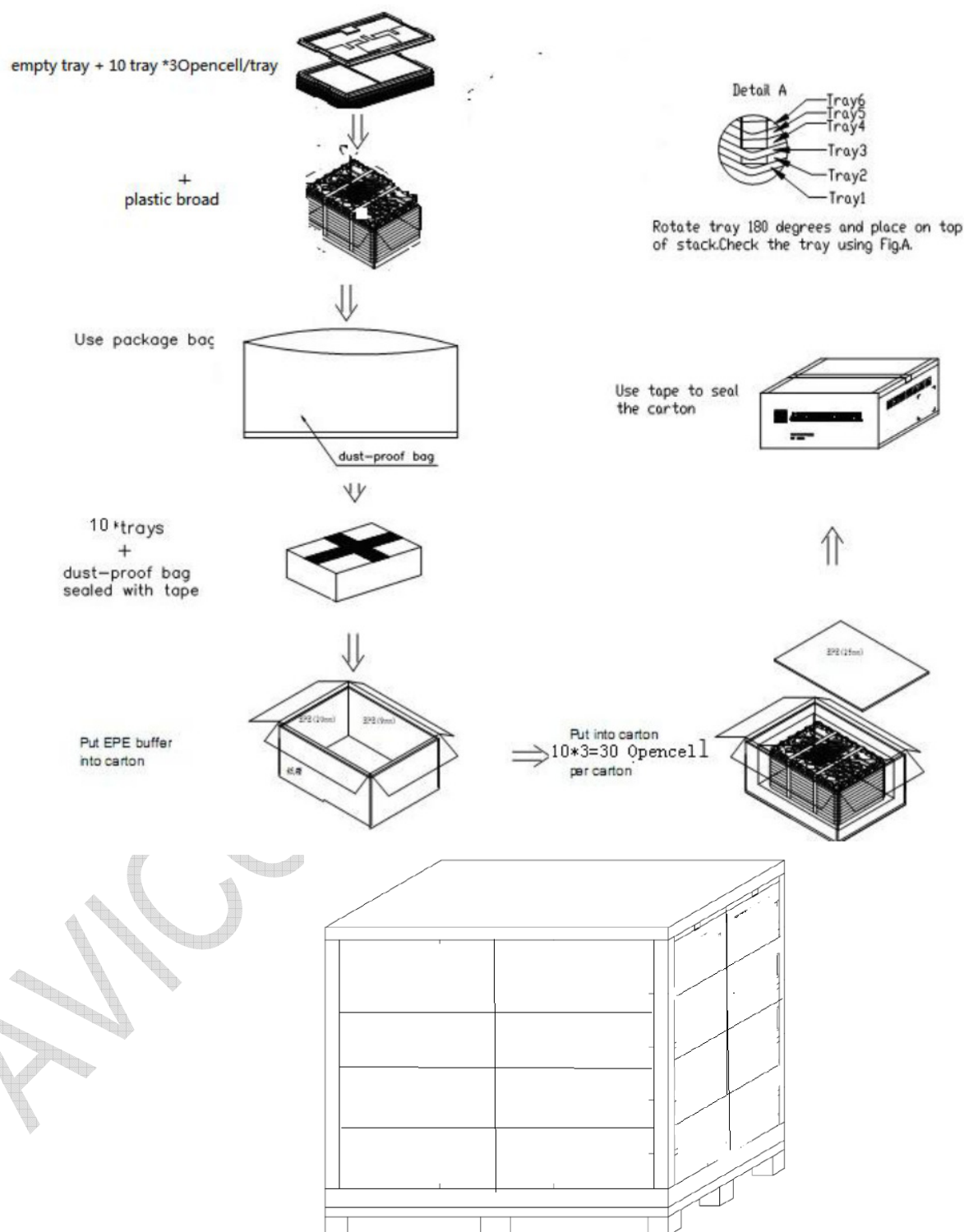


SHANGHAI AVIC OPTOELECTRONICS

Q/S1016-2011

## 11.6 OUTLINE FIGURE FOR PACKING (For reference)

Packing box and pallet packing



Note: The ways for Packing and Shipping vary from different shipment volume, dependent on specific situations.

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## 12. PRECAUTIONS

### 12.1 ASSEMBLY AND HANDLING PRECAUTIONS

- 1) Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deals with the product, because products may be damaged by electrostatic.
- 2) Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.
- 3) In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environment temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state)
- 4) This product is not designed as radiation hardened.
- 5) To assemble backlight or install module into user's system, it should be in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- 6) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- 7) It is dangerous that moisture come into or contacted the product, because moisture may damage the product when it is operating.
- 8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage condition.
- 9) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.
- 10) Do not apply rough force such as bending or twisting to the product during assembly.
- 11) It's not permitted to have pressure or impulse on the module because the LCD panel will be damaged.
- 12) Do not pull the I/F connector in or out while the module is operating.
- 13) After the product's end of life, it is not harmful in case of normal operation and storage.

### 12.2 OTHER

All GND and VCC terminals should be used without a non-connected line.

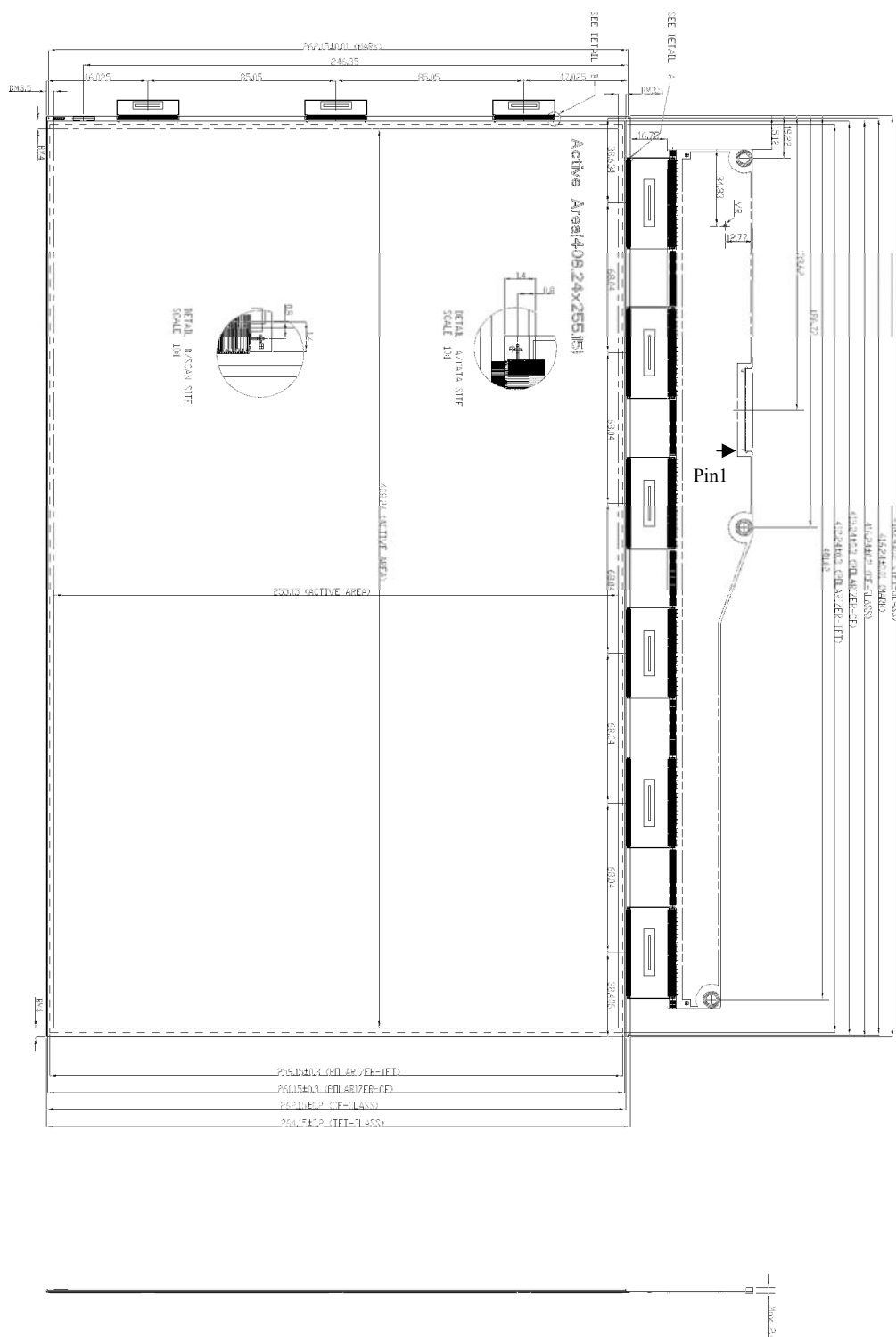
**The following items are neither defects nor failures.**

- 1) Response time, luminance and color may be changed by ambient temperature.
- 2) The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.
- 3) The interference noise of input signal frequency for this product and luminance control frequency of customer's backlight inverter may appear on a display. Set up luminance control frequency of backlight inverter so that the interference noise does not appear.





## 13. OUTDRAWING



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